

Math 190 Lab 7: Oct 27 and 29

Work through the following problems while the instructor and TA circulate. No homework this week on account of the midterm. See the reverse for more midterm review.

Warm up: Differentiate the following

- $\ln x$
- $\ln(\sqrt{2x+3})$
- $\sqrt{\sin x + x^3}$
- $\cos(e^{-x})$

Questions:

1. Consider the function

$$f(x) = \frac{-2x^2 + 3x}{x + 1}.$$

- (a) Compute the derivative of $f(x)$ using Quotient Rule.
- (b) Now compute the derivative using Product Rule and Chain Rule together. Do this by writing

$$f(x) = (-2x^2 + 3x)(x + 1)^{-1}.$$

Do you get the same result?

2. Find the equation of the tangent line to

$$g(x) = e^{\cos x}$$

at the point $x = \pi/2$.

Math 190: Midterm Practice Problems

1. Differentiate the following functions

(a) $e^{x \cos x}$

(b) $\frac{\sin x}{3(x+1)}$

(c) $\sqrt{e^{2x} + \cos(x + x^{1/3})}$

(d) $\ln\left(\frac{1}{x\sqrt{3x+1}}\right)$

2. Find all x values where the following function has horizontal tangent lines

$$f(x) = x^3 - \frac{1}{2}x^2 - 2x + 1700.$$

3. Draw the graphs of: $\sin x$, $\cos x$, e^x , $\ln x$ and identify any asymptotes.

4. How many times can a function cross its horizontal asymptote? Explain and provide an example.

5. If $f(x)$ has a vertical asymptote at $x = 2$ can $f(2) = 4$? Explain and provide an example.

6. Find all vertical and horizontal asymptotes of

$$\frac{x-2}{x^2+2x-3}.$$

Ensure you show the computation of all relevant limits.

7. (a) Find the derivative of $f(x) = \sqrt{2x+3}$ using the limit definition.

(b) Find the derivative again using another method of your choosing.

8. Compute the following limits. If the limit does not exist explain why.

(a) $\lim_{x \rightarrow 1} \frac{|x-1|}{x^2+2x-3}$

(b) $\lim_{x \rightarrow 10} \frac{\sqrt{x-1}-3}{x-10}$

9. Find all $x \in [0, 2\pi)$ such that the function

$$g(x) = \cos(2x) - \frac{x}{2}$$

has horizontal tangent lines.

10. Consider the function $f(x) = x^5$.

(a) What is the derivative of $f(x)$?

(b) Rewrite $f(x)$ so that you can take the derivative using a rule other than Power Rule. Name the rule you are using and confirm that your result is the same as that from part (a)

(c) Repeat part (b) as many times as you are able using a different rule each time.